



U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ENTOMOLOGY—BULLETIN No. 99.

L. O. HOWARD, Entomologist and Chief of Bureau.

---

PAPERS ON INSECTS INJURIOUS TO CITRUS  
AND OTHER SUBTROPICAL FRUITS.

---

CONTENTS AND INDEX.

---

ISSUED SEPTEMBER 12, 1916.



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.

1916.

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
5 CENTS PER COPY

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ENTOMOLOGY—BULLETIN No. 99.

L. O. HOWARD, Entomologist and Chief of Bureau.

---

PAPERS ON INSECTS INJURIOUS TO CITRUS  
AND OTHER SUBTROPICAL FRUITS.

---

I. THE ORANGE THRIPS:

A REPORT OF PROGRESS FOR THE YEARS 1909 AND 1910.

By F. R. JONES AND J. R. HORTON,  
*Agents and Experts, Deciduous Fruit Insect Investigations.*

II. THE RED-BANDED THRIPS.

By H. M. RUSSELL, *Entomological Assistant.*



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1914.

BUREAU OF ENTOMOLOGY.

L. O. HOWARD, *Entomologist and Chief of Bureau.*  
C. L. MARLATT, *Entomologist and Assistant Chief of Bureau.*  
E. B. O'LEARY, *Chief Clerk and Executive Assistant.*

F. H. CHITTENDEN, *in charge of truck crop and stored product insect investigations.*  
A. D. HOPKINS, *in charge of forest insect investigations.*  
W. D. HUNTER, *in charge of southern field crop insect investigations.*  
————— *in charge of cereal and forage insect investigations.*  
A. L. QUAINANCE, *in charge of deciduous fruit insect investigations.*  
E. F. PHILLIPS, *in charge of bee culture.*  
A. F. BURGESS, *in charge of gipsy moth and brown-tail moth investigations.*  
ROLLA P. CURRIE, *in charge of editorial work.*  
MAFEL COLCORD, *librarian.*

INVESTIGATIONS OF INSECTS AFFECTING TROPICAL AND SUBTROPICAL FRUITS.

C. L. MARLATT, *in charge.*

R. S. WOGLUM, W. W. YOTHERS, and J. D. NEULS, *entomological assistants.*  
E. R. SASSCER, J. R. HORTON, H. L. SANFORD, E. W. RUST, and A. D. BORDEN,  
*scientific assistants.*

# INDEX.

Almond, Mexican. (See <i>Terminalia catappa</i> .)	Page.
<i>Anacardium occidentale</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
Apricot. (See <i>Prunus armeniaca</i> .)	
Avocado (see also <i>Persea gratissima</i> )—	
food plant of <i>Heliothrips haemorrhoidalis</i> .....	19
food plant of <i>Heliothrips rubrocinctus</i> .....	17, 19
Bean thrips. (See <i>Heliothrips fasciatus</i> .)	
"Blight," so-called, of cacao, due to <i>Heliothrips rubrocinctus</i> .....	18
cacao (see also <i>Theobroma cacao</i> )—	
food plant of <i>Heliothrips rubrocinctus</i> .....	17, 18
food plant of <i>Mesothrips ficorum</i> .....	17
cacao thrips," colloquial name for <i>Heliothrips rubrocinctus</i> .....	17
shew, food plant of <i>Heliothrips rubrocinctus</i> .....	25
<i>trus aurantium</i> var <i>sinensis</i> , food plant of orange thrips.....	2
<i>trus decumana</i> , food plant of orange thrips.....	3
<i>trus</i> , food plant of <i>Euthrips occidentalis</i> .....	2
<i>trus japonica</i> , food plant of orange thrips.....	3
<i>trus medica</i> var <i>acida</i> , food plant of orange thrips.....	3
<i>trus medica</i> var <i>limon</i> , food plant of orange thrips.....	3
<i>trus nobilis</i> , food plant of orange thrips.....	3
<i>ffea liberica</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
ffee, Liberian. (See <i>Coffea liberica</i> .)	
ffion, food plant of <i>Heliothrips rubrocinctus</i> .....	25
ilivation against orange thrips.....	9
ock. (See <i>Rumex</i> sp.)	
ulsion, distillate-oil, and tobacco extract against orange thrips.....	10-15
uthrips citri. (See Orange thrips.)	
uthrips n. sp., description.....	4-5
uthrips occidentalis on citrus.....	2
uthrips tritici on oranges.....	2
umigation against orange thrips.....	10
rain thrips. (See <i>Euthrips tritici</i> .)	
rape, European. (See <i>Vitis vinifera</i> .)	
rapefruit. (See <i>Citrus decumana</i> .)	
reenhouse thrips. (See <i>Heliothrips haemorrhoidalis</i> .)	
uava. (See <i>Psidium guajava</i> .)	
uava, wild. (See <i>Anacardium occidentale</i> .)	
<i>Heliothrips fasciatus</i> —	
injury, character.....	19
prey of <i>Triphleps insidiosus</i> .....	28
<i>Heliothrips haemorrhoidalis</i> on mango and avocado.....	19
<i>Heliothrips (Physopus) rubrocincta</i> , bibliographic reference.....	29
<i>Heliothrips rubrocincta</i> , bibliographic reference.....	29

<i>Heliothrips rubrocinctus</i> —	Page.
adult, description.....	21
bibliography.....	28
classification.....	21
control, artificial.....	28
control, natural.....	28
description.....	21-23
egg, description.....	21
food plants.....	25
habits of adult.....	23-24
habits of larva.....	24
habits of prepupa and pupa.....	25
hatching of egg.....	24
history.....	17-19
injury, nature and extent.....	19-20
larva, first-stage, description.....	21
larva, second-stage, description.....	22
life cycle.....	25-27
nymph, full-grown, or pupa, description.....	22
nymph, young, or prepupa, description.....	22
origin and distribution.....	20
recent records.....	19
HORTON, J. R., JONES, P. R., and, paper, "The Orange Thrips: A Report of Progress for the Years 1909 and 1910".....	1-16
Hydrocyanic-acid gas. (See Fumigation.)	
JONES, P. R., and HORTON, J. R., paper, "The Orange Thrips: A Report of Progress for the Years 1909 and 1910".....	1-16
Kola (see also <i>Sterculia acuminata</i> )—	
food plant of <i>Heliothrips rubrocinctus</i> .....	18
Kumquat. (See <i>Citrus japonica</i> .)	
Lemon. (See <i>Citrus medica</i> var. <i>limon</i> .)	
Lime. (See <i>Citrus medica</i> var. <i>acida</i> .)	
Lime-sulphur and tobacco extract against orange thrips.....	10-15
<i>Mangifera indica</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
Mango (see also <i>Mangifera indica</i> )—	
food plant of <i>Heliothrips hæmorrhoidalis</i> .....	19
food plant of <i>Heliothrips rubrocinctus</i> .....	17, 18, 19
<i>Mesothrips flocorum</i> on cacao.....	17
<i>Olea europea</i> , food plant of orange thrips.....	3
Olive. (See <i>Olea europea</i> .)	
Orange—	
Australian Navel. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
food plant of <i>Euthrips tritici</i> .....	2
Homosassa. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Mediterranean Sweet. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Parson Brown. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Ruby Blood. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
St. Michael. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Satsuma. (See <i>Citrus nobilis</i> .)	
tangerine. (See <i>Citrus nobilis</i> .)	
Thompson improved. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Valencia Late. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	
Washington Navel. (See <i>Citrus aurantium</i> var. <i>sinensis</i> .)	

	Page.
Orange thrips—	
abundance and food plants, interrelation.....	7
broods, number.....	8
control methods, experiments.....	9-13
description and life history.....	4-6
egg, description.....	5
egg stage, length.....	8
food plants.....	2-3
habits.....	9
injury, character and extent.....	3
larva, description.....	5
larval stage, length.....	8
life cycle.....	8-9
original home and distribution.....	2
pupa, description.....	5-6
pupal stage, length.....	8
recommendations for control.....	13-15
seasonal history.....	6-7
summary.....	15-16
Peach. (See <i>Prunus persica</i> .)	
Pear. (See <i>Pyrus communis</i> .)	
Pepper tree, California. (See <i>Schinus molle</i> .)	
<i>Persia gratissima</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
<i>Physopus rubrocincta</i> —	
bibliographic references.....	28, 29
= <i>Heliothrips rubrocinctus</i> .....	17
Plum, European. (See <i>Prunus domestica</i> .)	
Pomegranate. (See <i>Punica granatum</i> .)	
<i>Portulaca oleracea</i> , food plant of orange thrips.....	3
<i>Prunus armeniaca</i> , food plant of orange thrips.....	3
<i>Prunus domestica</i> , food plant of orange thrips.....	3
<i>Prunus persica</i> , food plant of orange thrips.....	3
<i>Psidium guajava</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
<i>Punica granatum</i> , food plant of orange thrips.....	3
Purslane. (See <i>Portulaca oleracea</i> .)	
<i>Pyrus communis</i> , food plant of orange thrips.....	3
Rains in control of <i>Heliothrips rubrocinctus</i> .....	29
Raspberry, red. (See <i>Rubus idaeus</i> .)	
Red-banded thrips. (See <i>Heliothrips rubrocinctus</i> .)	
<i>Rosa</i> sp., food plant of orange thrips.....	3
Rose. (See <i>Rosa</i> sp.)	
Roses, food plants of <i>Heliothrips rubrocinctus</i> .....	25
<i>Rubus idaeus</i> , food plant of orange thrips.....	3
<i>Rumex</i> sp., food plant of orange thrips.....	3
RUSSELL, H. M., paper, "The Red-banded Thrips ( <i>Heliothrips rubrocinctus</i> Giard)".....	17-29
<i>Salix</i> sp., food plant of orange thrips.....	3
<i>Schinus molle</i> , food plant of orange thrips.....	3
Soap, whale-oil, tobacco extract, and water against red-banded thrips.....	28
<i>Solanum</i> sp., food plant of orange thrips.....	3
Spraying against orange thrips.....	10-13
<i>Sterculia acuminata</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
<i>Terminalia catappa</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25
<i>Theobroma cacao</i> , food plant of <i>Heliothrips rubrocinctus</i> .....	25



	Page.
Tobacco extract—	
and distillate-oil emulsion against orange thrips.....	10-15
and lime sulphur against orange thrips.....	10-15
whale-oil soap, and water against red-banded thrips.....	28
<i>Triphleps insidiosus</i> —	
enemy of <i>Heliothrips fasciatus</i> .....	28
probable enemy of <i>Heliothrips rubrocinctus</i> .....	28
“Umbrella tree,” food plant of orange thrips.....	3
Umbrella tree. (See <i>Terminalia catappa</i> .)	
<i>Vitis vinifera</i> , food plant of orange thrips.....	3
Willow. (See <i>Salix</i> sp.)	

# CONTENTS

	Page.
The orange thrips: A report of progress for the years 1909 and 1910.....	1
.....P. R. Jones and J. R. Horton.....	1
Introduction.....	1
Original home and distribution.....	2
Food plants.....	2
Character and extent of injury.....	3
Description and life history.....	4
The adult.....	4
The egg.....	5
The larva.....	5
The pupa.....	5
Seasonal history.....	6
Interrelation of abundance of thrips and food plants.....	7
Life cycle.....	8
Habits.....	9
Experiments with methods of control.....	9
Cultivation.....	9
Fumigation.....	10
Spraying.....	10
Experiments to determine killing effect of different sprays.....	10
Experiments to prevent marking of the fruit.....	10
Experiments with nursery trees.....	12
Spray injury.....	13
Recommendations.....	13
Time of application.....	13
Spray dilutions.....	13
How to spray.....	14
Summary.....	15
The red-banded thrips ( <i>Heliothrips rubrocinctus</i> Giard).....	17
.....H. M. Russell.....	17
Introduction.....	17
History.....	17
Recent records.....	19
Nature and extent of injury.....	19
Origin and distribution.....	20
Classification.....	21
Description.....	21
The adult.....	21
The egg.....	21
The first-stage larva.....	21
The second-stage or mature larva.....	22
The young nymph or prepupa.....	22
The full-grown nymph or pupa.....	23
Habits of the adult.....	23
Hatching of the egg.....	24
Habits of the larva.....	24
Habits of the prepupa and pupa.....	25
Food plants.....	25
Life cycle.....	25
Natural control.....	28
Artificial control.....	28
Bibliography.....	28
Index.....	31

## ILLUSTRATIONS.

### PLATES.

PLATE I. Fig. 1.—Young oranges showing injury by the orange thrips ( <i>Euthrips citri</i> ). Fig. 2.—Young oranges showing injury to stem and blossom ends by the orange thrips.....	Page 4
II. Mature oranges showing injury due to the orange thrips.....	4
III. Orange foliage showing curled and distorted condition of leaves due to work of the orange thrips.....	4
IV. Leaves of mango injured by the red-banded thrips ( <i>Heliothrips rubrocinctus</i> ).....	20
V. The red-banded thrips ( <i>Heliothrips rubrocinctus</i> ): Fig. 1.—Adult female. Fig. 2.—Full-grown larva. Fig. 3.—Prepupa. Fig. 4.—Pupa.....	24

### TEXT FIGURES.

FIG. 1. Diagram illustrating the relative abundance of orange thrips on oranges, on orange foliage, and on other plants during the season.....	7
2. Power spraying outfit in use in spraying for the orange thrips.....	14

## ERRATA.

- Page 17, line 4 from bottom, after *Marchal* strike out *Craw*.  
 Page 17, line 9 from bottom, for *Physophus* read *Physopus*.  
 Page 18, line 19 from bottom; page 21, line 3; page 28, lines 7 and 10 from bottom; page 29, lines 11, 13, 15, 19, 33, for *Physophus* read *Physopus*.  
 Page 28, lines 7 and 10 from bottom, for *rubrocinctus* read *rubrocincta*.





